

Possible Orbit Separator for the IP in RHIC

S. Y. Lee

BNL

February 21, 1989

To avoid the beam-beam effect of unwanted collisions in the collider, Beam-Beam separators are usually used to separate two beams. For RHIC operation in the high luminosity mode, the practice is also important.

There are many methods to separate the beams at the interaction points. In the following, we shall describe an efficient ~~method~~^{way} of using the phase advance of 90° from the IP to the high β quadrupole for beam separation. Since there are dipole correctors (β_b) in each quadrupole, we shall use α_0 next to the defocusing quadrupoles Q4I, Q2I, Q30 and Q50.

and IP to Q₃₀

The phase advance from IP to Q_{2I} are respectively $\frac{\pi}{2}$

with a kicker arm of $\sqrt{\beta_i \beta_f} \sin \Delta\mu = \sqrt{1250} \approx 35 \text{ m}$.

Thus a kicker strength of 0.1 mrad can create about 35 mm

of orbit distortion. The orbit however should be corrected

to nearly zero elsewhere. The ~~correctors~~ ^{a₀} correctors

at Q_{4I} and Q₅₀ are excited ^{then} to eliminate the

residual effect. Fig. 1 shows the orbit bump for

the $\beta^* = 6 \text{ m}$ lattice at ~~the~~ superperiodicity 3. The

closed residual orbit excursion is ~~about~~ less than 0.13 mm. If

Fig. 2 shows the γ_0 in the lattice with

five, $\beta^* = 6 \text{ m}$ insertions and one $\beta^* = 2 \text{ m}$ insertion.

The closed orbit a_0 dipoles are excited to ~~reach~~ ^{reach} the

proper beam separation at these $\beta^* = 6 \text{ m}$ insertion

The effect of $\beta^*=2m$ insertion gives the residual effect of $y_{co} \leq 0.5$ mm at the $\beta^*=2m$ insertion. Due to the antisymmetric structure of the insertion, the $y_{co} \approx 0.02$ mm at the IP of $\beta^*=2m$. We feel that the effect to the collision rate should be small. This effect can however be corrected by the ~~the~~ orbit correctors in the $\beta^*=2m$ insertion,

Fig. 3 shows the y_{co} as a function of the kicker strength at Θ_{2I} . The strength of other kickers ~~are shown for~~ is related to Θ_{2I} by

$$\Theta_{4I} = \frac{1.15}{2.15} \Theta_{2I}$$

$$\Theta_{30} = \frac{1.95}{2.15} \Theta_{2I}$$

$$\Theta_{50} = \frac{-89}{2.15} \Theta_{2I}$$

Because of these orbit bumps, the beam may move

into the nonlinear region of the magnets. One should

compromise between large beam-beam separation for

minimizing beam-beam interaction and the nonlinear

effect due to the magnets. Some types of tracking

study simulation may be useful

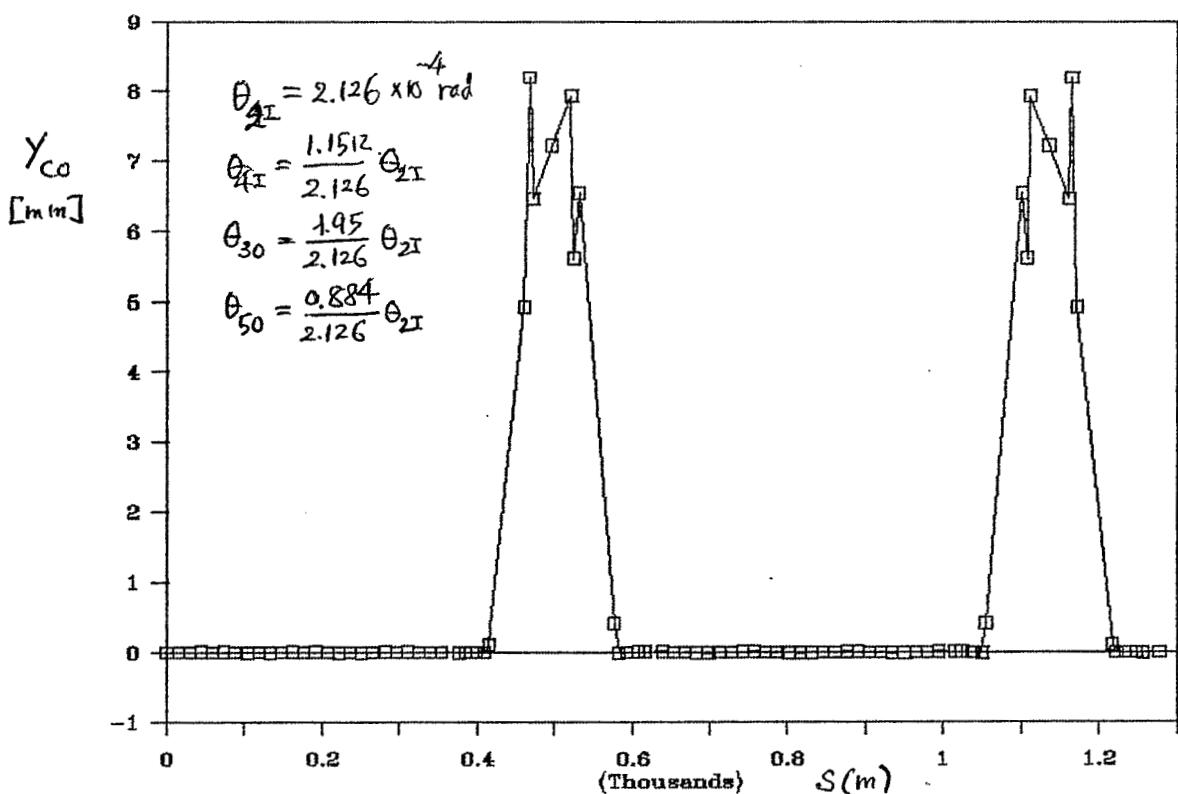
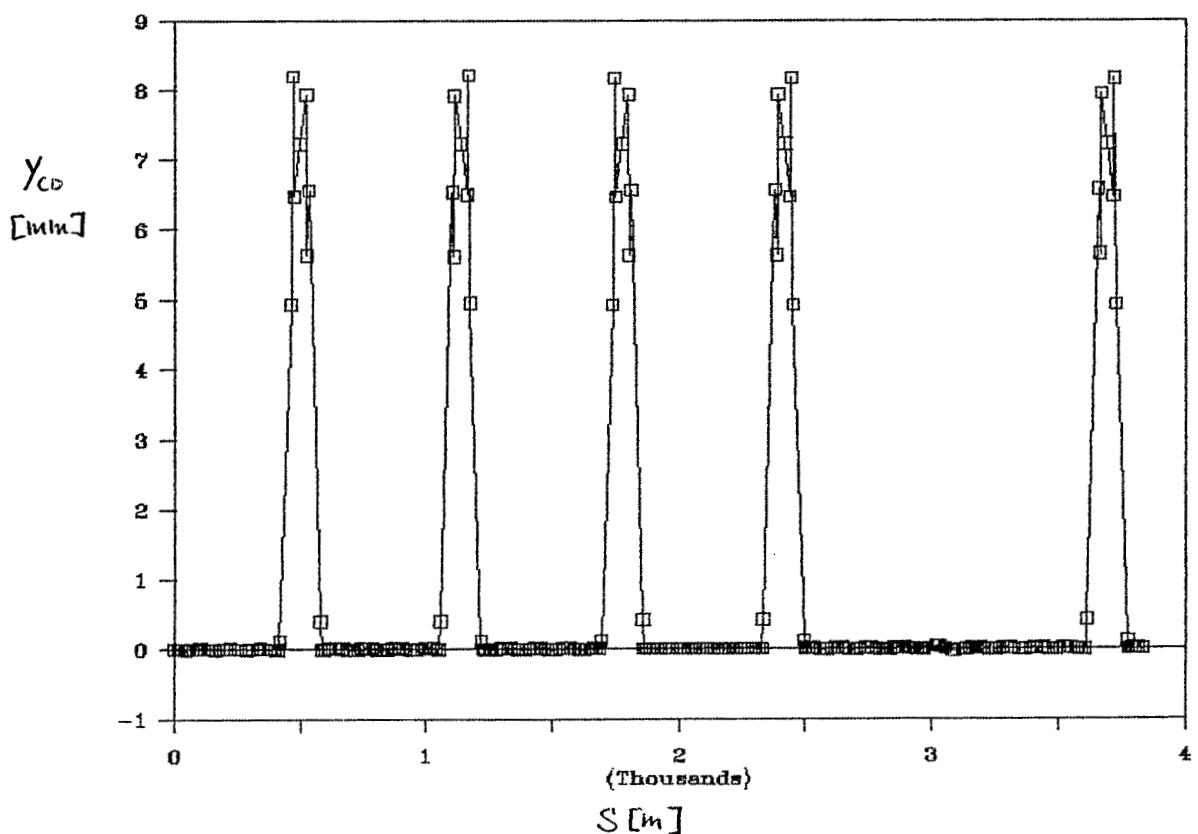


Fig.1 Y_{CD} for $\beta^* = 6$ m with 3 superperiod

Fig.2 Y_{CD} for 5 $\beta^* = 6$ m insertion and one $\beta^* = 2$ m insertion



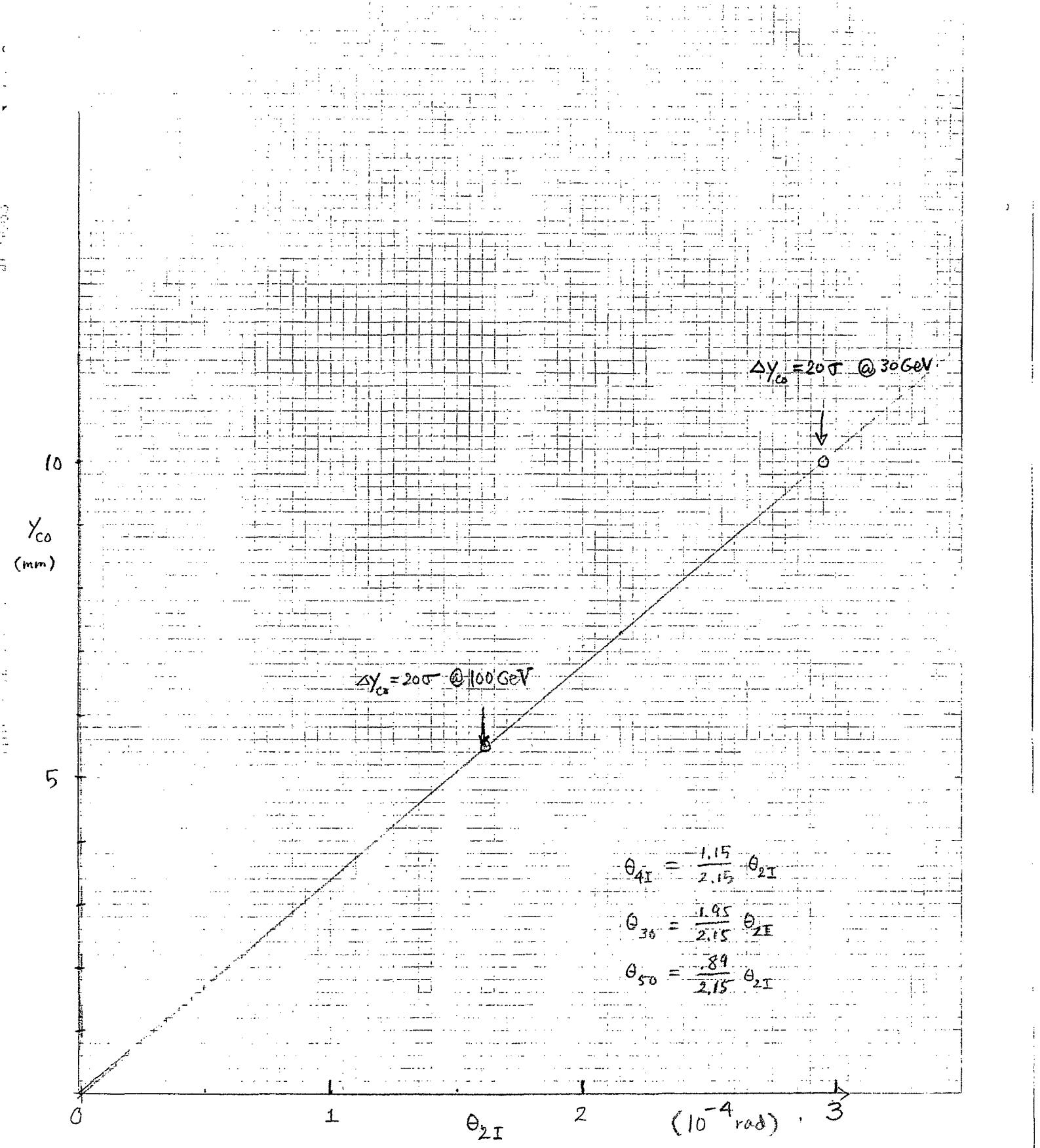


Fig. 3 $Y_{c\bar{c}}$ (mm) vs θ_{2I}